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Managing Emerald Ash Borer

A Resilient Communities Project–GreenStep Cities Guide

Resilient Communities Project

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This report was produced by the Resilient Communities Project (RCP), a program at the University of Minnesota whose mission is to connect communities in Minnesota with U of MN faculty and students to advance local sustainability and resilience through collaborative, course-based projects. RCP is a program of the Center for Urban and Regional Affairs (CURA). More information at http://rcp.umn.edu. Funding for the report was provided by GreenStep Cities, a program of the Minnesota Pollution Control Agency, through a grant from the McKnight Foundation. More information at https://greenstep.pca.state.mn.us.

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City of North St. Paul: Emerald Ash Borer Management Plan

UMN Course: FR 4501/5501: Urban Forestry—Biology and Management
UMN Student Authors: Ricardo Braun, William Butler, Jeff Carroll, Mario Fagundes, Brandon Hull, Luke Midura, Lauren Stufft, and Zhezi Yang
City Project Lead: Jon Fure, Community Development Intern, City of North St. Paul
UMN Course Instructor: Gary Johnson, Department of Forest Resources, College of Food, Agricultural, and Natural Resource Sciences (CFANS)
Original Student Report: https://conservancy.umn.edu/handle/11299/194801

Does My Ash Tree Have EAB?

UMN Course: OLPD 5204: Designing Adult Education Programs
UMN Student Authors: Julia Dugan and Caroline Kirby
City Project Lead: Jon Fure, Community Development Intern, City of North St. Paul
UMN Course Instructor: Catherine Twohig, Department of Organizational Leadership, Policy and Development, College of Education and Human Development (CEHD)
Original Student Report: https://conservancy.umn.edu/handle/11299/194802

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INTRODUCTION

The thought of an EAB infestation can be overwhelming. For many cities, ash trees play an important role in the urban canopy. However, it is a problem we cannot ignore. EAB is already in Minnesota and will more than likely make its way to all corners of the state. The most important thing communities can do is to have a plan when EAB is identified. EAB can be managed, and there are steps every community can take to protect their urban canopy.

Photo courtesy of Tesha M. Christensen.

Tree tags used by the City of Minneapolis, Minnesota.

However, every action taken has both intended and unintended consequences; there is always some level of risk to everything we do. In treating EAB, communities do not want to swap out one problem for another. It is important to think carefully about the "acceptable risks" a community is willing to take ecologically, economically, and socially to manage EAB. An "acceptable risk" considers both the intended and unintended consequences and the level of risk or severity of those results. Are the benefits of the action and intended consequences worth the risk of the unintended consequences? Ultimately, "acceptable risks" will look different in each community, but all communities will try to seek actions that minimize unintended consequences, lessening the risks of their actions to more "acceptable" standards. This decision document is designed to help think through "acceptable risks" to begin an EAB management plan.

Why Care?

ECOLOGICAL BENEFITS

Forming an EAB plan can help save the urban canopy, which provides these benefits and others.

- Stormwater infiltration, pollution reduction, habitat for several species, soil stability, reduction in urban heat island effect

ECONOMIC BENEFITS

Forming an EAB plan can save the city and residents money. Communities can choose proactive, lower cost options before EAB arrives to prevent costly, reactive decisions. Likewise, communities can begin budgeting for EAB plans to soften the economic blow when the pest does arrive.

- Trees increase property values
- Trees reduce energy use
- Shade in Summer
- Windbreaks in Winter

SOCIAL BENEFITS

Trees help foster community and create a sense of place. Trees also provide health benefits for residents. Forming an EAB plan can help communities identify and protect priorities, as well as forming a plan that fits with community goals and values.

- Sense of place and community (ambiance and aesthetics)
- Mental and physical health benefits

Engagement and a strong sense of environmental stewardship in the community can increase the value residents place on nature, which may make the public more likely to support forestry and natural resource budgets. This can help communities develop and obtain canopy goals, provide resources to carry out an EAB plan, or help the community pursue related GreenSteps.

Photo courtesy of Pennsylvania Department of Conservation and Natural Resources

Emerald Ash Borer traces on a dead tree trunk. Right: Emerald Ash Borer.

What Can We Do?

EAB is not unmanageable. We are continually learning more about the insect, treatment options, and long-term effects. Forming an EAB management plan is an important step all communities can take to help mitigate the damage from EAB to Minnesota's ash trees and urban canopy. Three options are outlined below as well as the "default option" of doing nothing. These management strategies are not exclusive – strategies should be combined as resources and community needs allow. In developing an EAB plan, there may be push-back from the community that plans will break the budget. It is important to address these concerns and show the community that not having a plan is the most expensive option.

- Do nothing (there are serious consequences to this false helplessness)
- Preemptive remove of all ash
- Remove and replace ash
- Chemically treat ash

What are the Consequences of Actions?

Since there are intended and unintended consequences for all actions, the choices communities make regarding EAB treatment have ripple effects across the community.

DOING NOTHING

EAB will spread throughout the community once it arrives, ravaging ash trees. Both public and private trees will have to be removed as they are infected and conditions worsen. By far, study after study in universities across EAB-infected states suggest doing nothing is the costliest option for communities economically, ecologically, and socially.

Ecologic Impact

Hundreds of once healthy ash will be lost with no replacement scheduled or budgeted. These trees provided pollutant and stormwater services, among dozens of others; these services will be lost and cost communities financially in other ways (loss of shade trees, more health concerns, more prone to flooding, soil erosion or other storm damage, etc.)

Economic Impact

As trees grow sick and die, they become hazardous and must be removed safely before they harm people or property. It is expensive to remove trees, and it will be costly to remove several ash trees at the same time or within a short span of time. Funding from other programs may need to be reduced or cut to pay for all of the removals. Conversely, property taxes may need to be raised to cover costs. Private homeowners who cannot afford removal on their own will be fined by the city, which will be both burdensome and unpopular.

Social Impact

While waiting and doing nothing may provide more time for new treatments from research (which may reduce removal needs and costs), it is not a guarantee. Seeing hundreds of trees grow sick and die over a short period of time can hurt a community socially. Attachment and identity associated with trees are lost. Financial costs can cause social strains as communities reactively figure out how to pay for hundreds of removals. Doing nothing provides little educational opportunity and communicates to communities that there is nothing we can do to help trees and nature when threatened, which is untrue. This false sense of helplessness may decrease future stewardship and interest in nature.

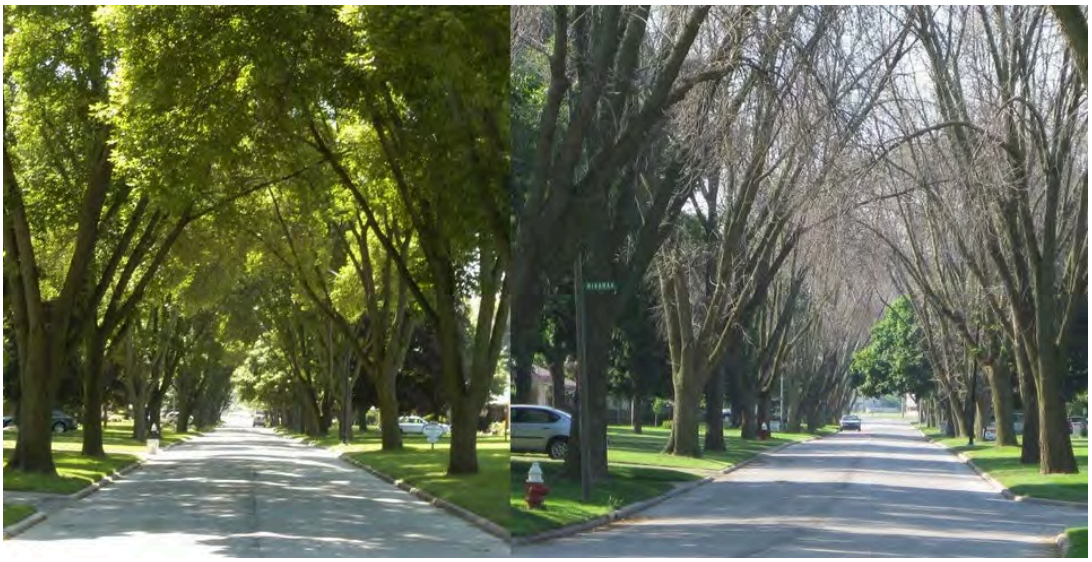

Photo courtesy of Dan Herms, OSU.

Before and after - EAB damage after 3 years in Toledo, Ohio.

PREEMPTIVE REMOVAL OF ALL ASH

To spread out the costs of removing trees, some communities are electing to remove a portion or all of their public ash trees before EAB arrives.

Ecologic Impact

Removing ash trees before a full-on EAB infestation may lessen the severity of the pest when it arrives. Trees that will likely fall sick and die can be taken out to protect healthy, valuable trees. However, hundreds of healthy ash may be lost with no replacement scheduled, and potentially not budgeted, if communities choose to remove all ash regardless of condition. These trees provided pollutant and stormwater services, among others; these services will be lost and cost communities financially in other ways (loss of shade trees; more health concerns; more prone to flooding, soil erosion or other storm damage; etc.)

Economic Impact

Starting ash tree removal before EAB arrives can spread out the financial burden. Trees can be removed each year as the budget allows, avoiding cuts in other areas or increased taxes. Additionally, removal of ash trees before they become sick provides the opportunity to use the wood for products or local firewood at its maximum value. However, removal is still expensive. Removing public ash as a mitigation strategy for private homeowners is not a guarantee. While there will be fewer ash impacted when EAB arrives, it will still cost homeowners.

Social Impact

Seeing hundreds of trees removed over a short span of time can hurt a community socially by generating negative feelings. Attachment and identity associated with trees are lost. Removing ash trees preemptively may help educate the community about EAB but could also create a sense of helplessness and defeat that would decrease stewardship if all ash are removed. On the other hand, removal and education could generate interest and a sense of stewardship in the remaining canopy to prevent another insect or disease from damaging another large portion of the canopy. Removal does not facilitate further research of EAB or potential treatments.

Wood Reutilization Sources

Community Urban Wood Utilization Planning Worksheet

Worksheet that poses several questions communities need to consider to make the right choice for them.

http://semircd.org/ash/news/UrbanWoodUsePLanningWorksheet.pdf

Cost-Effective Tree Removal and Utilization Strategies to Address Invasive Species Attacks

Some good thought points, a little less organized than above resource

http://semircd.org/ash/news/Cost%20Effective%20Tree%20Removal.pdf

Wood Utilization Options for Urban Trees Infested by Invasive Species

Very detailed, not sure how helpful. Seems to go through individual markets for woods and products

http://www.emeraldashborer.info/documents/wooduse/UtilizationOptionsForUrbanTrees.pdf

REMOVE AND REPLACE

Replacing ash lost to EAB or preemptive removal is one way to mitigate the loss of hundreds of trees and begin to rebuild the urban canopy. Most cities are taking a "no ash, priority on native tree" policy in replanting.

Ecologic Impact

The loss of mature trees will decrease the amount of ecosystem services provided by the trees. However, new plantings can help urban tree canopy recover from the loss of ash. Diversity should be encouraged to avoid other pests and diseases from destroying another large portion of the canopy. However, some communities have few options for hardy trees. Blue and Manchurian ash grow in Minnesota's ecological region and are hardier than black, green, and white ash when exposed to EAB. Another concern with replanting several trees at one time is age diversity. A canopy that is approximately the same age may cause future problems. For example, a strong storm could come through and wipe out the replanted trees since they all have about the same establishment. Age diversity is just as important as genus and species diversity. Replacing trees as they succumb to EAB creates more age diversity than removing and replacing all at once.

Economic Impact

Again, tree removal is expensive. New trees cost money too though they can be planted at little to no cost by community volunteers. Young trees need maintenance to grow into trees that provide services and that people love. Communities will be paying for the gap in ecological services until, and if, the tree matures to the height and DBH of lost ash. Additionally, the staggered removal of ash trees provides the opportunity to use the wood for products or local firewood. Even diseased wood can be used, just not at its highest value. Staggered removal also allows communities to better budget for replacement.

Social Impact

Replacing trees lost to EAB will help communities bounce back. New trees are planted to mitigate negative feelings from the loss of ash trees and allow new tree attachments and identities to be formed. Removal and replanting provide educational and engagement opportunities. Understanding why trees are being removed and the types of trees replacing them (especially if community has some input in what types of trees are planted) offer great learning opportunities. Community plantings can excite residents about trees, the urban canopy, and stewardship. However, it does not facilitate further research of EAB and potential treatments.

Photo courtesy of Casey Trees.

Reforesting public areas.

CHEMICALLY TREAT

Treating ash trees with insecticides can prolong their lives to disperse removal costs or to keep them alive throughout the infestation. There are several factors to consider when choosing chemical treatments. **Incorrect application of insecticides can cause just as much ecological and financial damage as EAB.**

Ecologic Impact

Depending on the type of insecticide used and its correct application, there are different ecological consequences and considerations. It is important to remember that EAB is relatively new to United States, and new studies on the effects of chemical treatments are constantly being done to better inform our treatment choices and uses, particularly long term.

Economic Impact

Treating ash trees costs money. However, treatments can be used to disperse the larger financial costs of removing trees. They can also be used to preserve trees that provide several ecological services, saving the community money. However, they can be a waste of money and time if applied to trees that have significant decline (30% canopy loss or more) and are past the point of saving. If applied incorrectly, they can cost money in the future to mitigate impacts of unintended consequences, the scope of which are unknown.

Social Impact

There is the potential for pubic pushback against chemical treatments. Residents may be concerned about pollinator health or water quality and may be against any form of chemical control. Education may ease tensions, but it will not remove all concerns. Likewise, residents may be confused or upset that funds are being used to treat trees that are "destined to die." Treating ash trees may seem like a waste of money or time to residents. Likewise, they may be upset that their street tree was not selected for treatment while one down the block was. Residents may be more supportive of treatment if they understand how trees are selected for treatment, how the treatment is applied, and the likelihood potential risks will occur. There is great potential here for research, education, and community engagement/volunteers to foster stewardship in ash trees and the urban canopy.

Application Methods

1 SPRAYS

While sprays are readily available to both homeowners and professionals, they are **not** recommended. There are too many risks associated with their use and are the least direct/effective way to manage EAB.

2 SOIL DRENCHES

Soil drenches are applied around the base of the tree. The intent is for the tree to absorb the chemical through its roots. When EAB enters the tree, they are exposed to the insecticide. While more direct than sprays, there are still potential risks. Studies are still determining how much of the drench is absorbed by trees compared to plants within the treatment area, when applied properly. There is a chance that non-target plants within the treatment area may absorb the chemicals, including plants pollinators visit like clover and flowers. Likewise, soil drenches increase the risk for chemical runoff and water pollution, which could harm aquatic species and degrade water quality.

3 TRUNK INJECTIONS

This is the most direct treatment for EAB currently available. A small hole is drilled into the tree to administer the treatment. The treatment is absorbed by the tree and harms EAB when it enters the tree. Since ash trees are wind pollinated, there is little chance that pollinators will be exposed to the chemical, unless accidentally spilled. Likewise, direct injection reduces runoff potential. There is a small risk of damage to the tree if the hole is improperly drilled, making it more prone to disease and damage.

Insecticides

The following three treatments are the most common treatments for EAB in Minnesota. Other treatments exist, but they are not likely to be widely used and are not recommended given the greater risks and damages associated with their use.

- **Imidacloprid** is a neonicotinoid widely available to professionals and homeowners for EAB and Japanese beetle treatments, among other uses. It is highly toxic to several insects, including pollinators. It is also slightly toxic to fish and some bird species. Currently, MDA tests waters annually for imidacloprid; the chemical is rarely detected since it is unstable in water and breaks down rapidly. It can be administered through sprays, soil drenches, and trunk injections and is recommended for an annual application.

- **Dinotefuran** is a neonicotinoid available to professionals and homeowners for EAB and other pest treatments. It is highly toxic to several insects, including pollinators. It is not toxic to fish, mammals, or birds. It is unstable in water and degrades rapidly. It can be administered through sprays, soil drenches, and trunk injections and is recommended for an annual application.

- **Emamectin Benzoate** is an avermectin only available to certified pesticide applicators and is primarily used for EAB treatments. It is highly toxic to pollinators, crustaceans, fish, and aquatic invertebrates. However, since it is only applied through trunk injections, there is little risk to these animals, unless accidentally spilled. It breaks down quickly in sunlight and has a low risk of groundwater contamination. It is recommended to inject trees every 2-3 years.

Pick Your Targets

Regardless of treatment method, it is important to pick target trees and areas. Smart selection and application of treatments can further save communities time and money.

TREE

It is important to consider the cost of treatment and the benefits gained: if a tree provides several ecological services, it may warrant treatment. If it provides few services relative to the cost of treatment, it may not be worth the investment.

How old is the tree?

Old and young trees are more vulnerable to attack and infection and may not fare well even with intervention. It may not be cost effective to treat it.

How big is it?

DBH, diameter at breast height (4.5 feet), is a good estimation for benefits gained. The spreadsheets accompanying this resource can help you determine the benefits (and costs) of trees to help pick your targets.

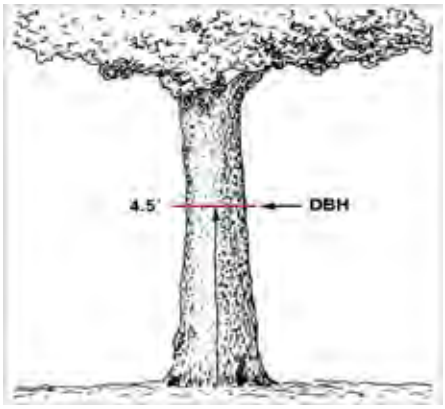

Image courtesy of Texas A&M Forest Service.

Diameter at Breast Height (DBH).

How healthy? Is there structural damage to the tree?

If a tree is unhealthy or damaged anyway, it will be more vulnerable to EAB or may even die before the pest arrives. It is not going to be cost effective to treat it.

Photograph by Richard J. Hauer.

Removal of an 110 year old ash tree in poor structural health.

LOCATION, LOCATION, LOCATION

The tree is worth saving given the previous parameters – great! Now, is it in the right place? A tree may be in the prime of its life but in a less than ideal location. Consider:

Infrastructure

Is the tree close to sidewalk and roads to prompt pavement upheaval? Is it underneath power lines or blocking a streetlight, traffic signal, or sightline? Is it too close to a building? If there is a strong potential for infrastructure conflicts now or in the future, it may not be worth treatment.

Future Land Use

Is a busy street going to be widened? Is there a new development or construction planned? What is the vision for the land in comprehensive plans? It makes little sense to save trees that will be removed in the near future for development. Likewise, if the tree is likely to sustain damage during construction that would degrade its quality or ultimately kill it, it may not be worth saving.

Environment

Is it close to running water or a storm drain? Are there other plants or trees in proposed treatment areas, especially those favored by pollinators? Is it close to other ash trees either receiving treatment? If applying chemical treatments in these areas, be mindful of correct application techniques and timing, and consider using the most targeted form of treatment.

IDENTIFY COST SAVINGS POTENTIAL

Several cost savings measures have added social benefits:

- Training residents to treat trees through trunk injections.
- Community volunteers chip and remove trees (professionals only have to fall them, saving their time and cutting removal costs).
- Community volunteers plant (and maybe care for) new trees. Partnerships with local businesses can be formed to offer incentives to care for trees for a growing season, like Brewing a Better Forest. To make it more family friendly, discounts or coupons could be offered at a local plant nursery, ice cream shop, grocery store, or fun family activity.
- Wood reclaiming projects can remove wood. Most will not pay for the wood. But if done in house (or through a deal with the organization) you may be able to reclaim the wood for other community needs, such as benches, school or library furniture, signs, or other needs.

Image courtesy of the City of Tacoma.

Tree coupon.

IS THE RISK ACCEPTABLE?

Given all of the economic, ecological, and social risks involved with treating this tree, both those mentioned in this resource and identified by the community, is it acceptable and appropriate to treat this tree/area? There is not right or wrong answer here; an acceptable level of risk is based on community values.

If, after considering the above variables, the community feels the risk is acceptable, the tree should be treated.

Hardier Varieties of Ash

BLUE ASH

- A native of midwestern North America, Blue Ash is often found at limestone outcrops and therefore thrives in dry soils of alkaline pH. It may grow to 80 feet tall by 40 feet wide, with a slow growth rate. Blue Ash adapts to a variety of stresses, especially to poor, dry, rocky soils. It grows in full sun to partial sun, and is found in zones 4 to 7. http://forestry.ohiodnr.gov/blueash

- Scientists recently determined that blue ash is relatively resistant to EAB, making it likely that this species will survive the EAB invasion. https://www.americanforests.org/magazine/article/will-we-kiss-our-ash-goodbye/

- Blue ash (F. *quadrangulata* Michx.) appears to be the most resistant North American ash species encountered by EAB to date (2, 103). More than 60% of blue ash in wooded areas in southeastern Michigan appeared healthy in 2011, whereas all white ash >10 cm in diameter in the same sites have been killed (103). (Emerald Ash Borer Invasion of North America: History, Biology, Ecology, Impacts, and Management, Daniel A. Herms, and Deborah G. McCullough (aka the national experts), Annual Review of Entomology)

- In two wooded areas with a mix of white ash and blue ash (F. *quadrangulata*), all or nearly all white ash trees were killed by EAB, while 60-70% of the blue ash survived the EAB invasion and remain healthy. (Tanis and McCullough 2012, Canadian Journal of Forestry)

- Green and black ash trees were heavily colonized and killed, while few galleries were found on any of the blue ash or Manchurian ash. (Tanis and McCullough 2015, Environmental Entomology)

Photograph by Karren Wcisel.

Blue Ash (Fraxinus *quadrangulata*).

- Some evidence that resistance weakens overtime, survival decreases. This may be due to more borers on the trees (since preferred black and green ash have died off) or something else. But due to higher natural resistance, fewer pesticides may need to be used, or their use may be able to be prolonged.

MANCHURIAN ASH

- Zones 2-6 (plus other good details) http://trees.umn.edu/nursery-tour/species/maas/

- Best grown in consistently moist, well-drained loams (clay or sandy) in full sun. Tolerates light shade. Adapts to dry soil conditions. Performs poorly in climates south of USDA Zone 6. http://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?taxonid=282961

- Asian ash species, such as Manchurian ash, which share a coevolutionary history with EAB, are more resistant, and appear to be susceptible only when stressed. Drought stress increases susceptibility of Manchurian ash to EAB, but has no effect on its bark phenolic content. (MECHANISMS OF ASH RESISTANCE TO EMERALD ASH BORER: PROGRESS AND GAPS, Caterina Villari1, Justin G. A. Whitehill1,2, Don F. Cipollini3 , Daniel A. Herms4 and Pierluigi Bonello1)

Photo courtesy of USDA-NRCS PLANTS Database.

Manchurian Ash (Fraxinus *mandshurica*).

- As EAB populations began to resurge and susceptible trees in the plot began to be killed, Manchurian ash has had the highest rate of survival and little canopy decline. Mortality of Manchurian ash that did occur was concentrated in the first few years after planting, perhaps due to transplant stress. The only tree killed after 2009 had its trunk badly injured by a deer rub. The high EAB resistance of this Manchurian ash population of seedling origin is consistent with that observed by Rebek et al. (2008) for the clonal Manchurian ash cultivar 'Mancana,' suggesting that EAB resistance is a species-level trait. (INTERSPECIFIC PATTERNS OF ASH DECLINE AND MORTALITY IN A COMMON GARDEN, Daniel A. Herms, David R. Smitley, and Bert Cregg)

Resources

http://www.myminnesotawoods.umn.edu/eab/eabmanual/
http://www.myminnesotawoods.umn.edu/eab/
http://www.extension.umn.edu/garden/insects/find/emerald-ash-borer/
http://www.rochestermn.gov/home/showdocument?id=10218
http://www.treebenefits.com/calculator/

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